

Magnetic Levitation



Maglev

- Instead of engines, Maglev vehicles use **electromagnetism** to **levitate** (raise) and propel the vehicle.



Maglev

*Imagine **floating 12 centimeters off the ground** while traveling at **500 kilometers an hour**! There is no sound of steel wheels banging into steel rails, no humming of motors, just the sound of the air rushing by! Computers automatically control your speed and position. Is this possible?*

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Advantages and Disadvantages

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- Magnetic Levitation (Maglev) is a generic term for any transportation system in which vehicles are suspended and guided by magnetic forces.



Benefits of Maglev

- Can travel up to 500 kilometers per hour (~310mph)
- Maglev trains float, there is no friction.

Benefits of Maglev

- Maglev uses 1/3 the energy of airplanes!
 - Conserving energy means using up fewer natural resources and creating less pollution.

Disadvantages

- Costly
- Numerous tracks needed
- No infrastructure
- Inconvenient

Benefits of Maglev

- Because the train floats along there is no contact with the ground and therefore no need for any moving parts. As a result there are no components that would wear out. This means *in theory* trains and track would need no maintenance at all.

Two Types of Maglev

- Electromagnetic Suspension (EMS)
- Electrodynamic Suspension (EDS)

Benefits of Maglev

- Less noise! Because there are no wheels running along there is no wheel noise.

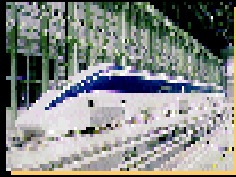
Electromagnetic Suspension (EMS)


- **EMS** depends on **attractive force**.
- Electromagnets on the vehicle are drawn toward a pair of steel rails.
- Most of the vehicle rides above the rails but the magnets wrap beneath the rail.



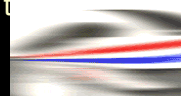
Electrodynamic Suspension (EDS)

- EDS is based on **repulsive force**.
- The vehicle contains superconducting magnets that induce a repulsive force in a conducting guide way as the vehicle moves along it.



- 1900 – Robert Goddard and Emile Bachelet conceive the concept of frictionless trains. 

The History of Magnetic Levitation Vehicle

- 1969 – American scientist James R. Powell and Gordon T. Danby patented the first design for Maglev train. 

- 1750 – John Mitchell conducted the first experiments measuring the magnetic forces between the poles of a magnet. The principle of magnetic force is critical to Maglev train operation.

- 1970 – German and Japanese engineers start research and development towards their versions of Maglev technology.

- 1990 –
The initial phase of
the Yamanashi
Maglev Test Line
commences.



- 2003 – The Shanghai Transrapid
Maglev Line is inaugurated.

